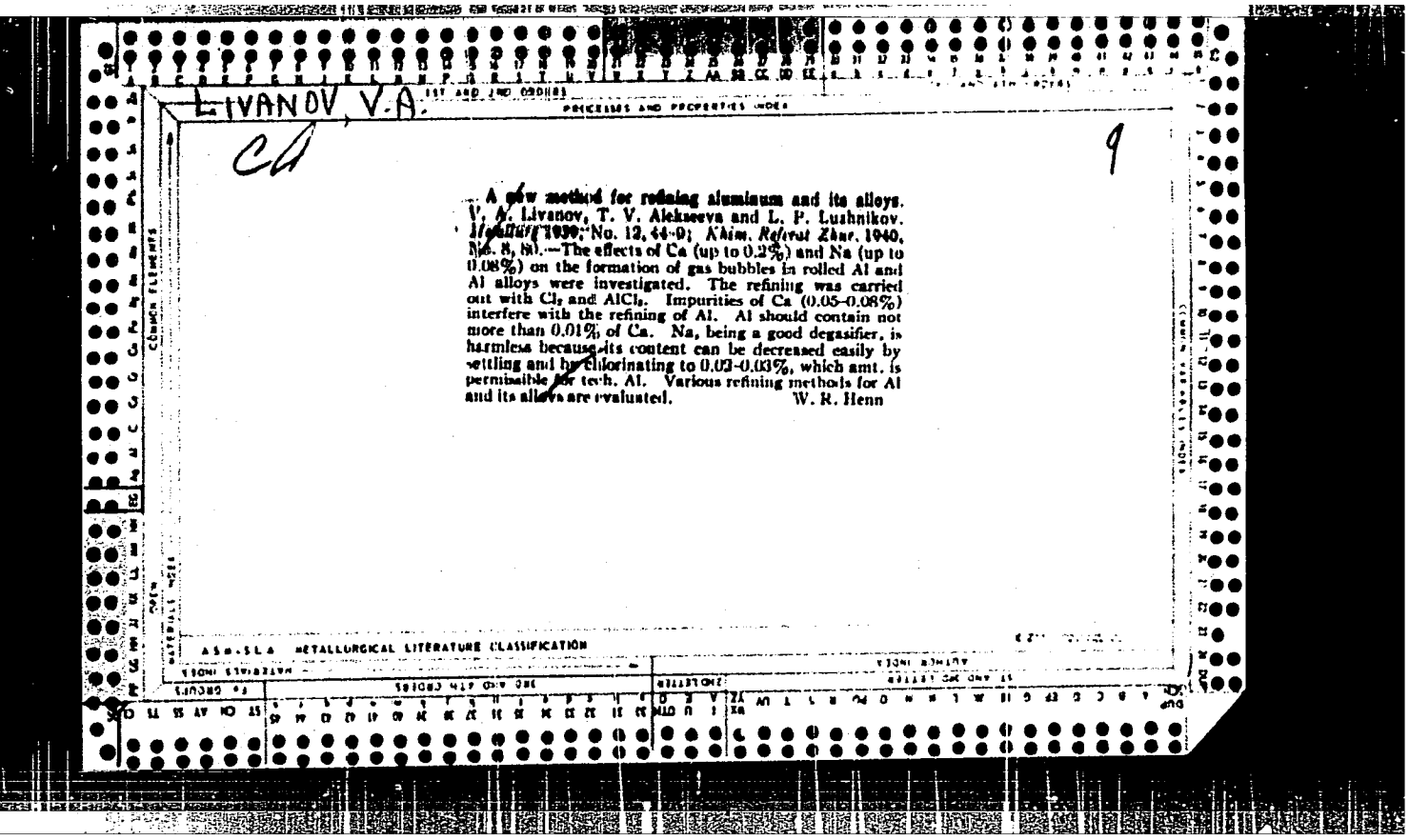

LIVANOV, V.A.

CA

9

A new method for refining aluminum and its alloys. V. A. Livanov, T. V. Alekseeva and L. P. Lushnikov. *Metallurg* 1939, No. 12, 44-9; *Chim. Referat Zhur.* 1940, No. 8, 80.—The effects of Ca (up to 0.2%) and Na (up to 0.08%) on the formation of gas bubbles in rolled Al and Al alloys were investigated. The refining was carried out with $Cl_2$ and $AlCl_3$. Impurities of Ca (0.05–0.08%) interfere with the refining of Al. Al should contain not more than 0.01% of Ca. Na, being a good degasifier, is harmless because its content can be decreased easily by settling and by chlorinating to 0.03–0.03%, which amt. is permissible for tech. Al. Various refining methods for Al and its alloys are evaluated. W. R. Henn

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

LIVANOV, V. A.

Tempering sheet alclad (aluminum-coated duralumin) Moskva, Gos. izd-vo obor. promyshl., 1940. 123 p. (50-47256)

Microfilm TS-7

LIVANOV, V.A., kandidat tekhnicheskikh nauk, dotsent; KOLPASHNIKOV, A.I., kandidat tekhnicheskikh nauk, dotsent; IVANOV, I.I., kandidat tekhnicheskikh nauk.

Thermal effect in aluminum deformation. Trudy MATI no.28:41-45 '55. (Deformations (Mechanics)) (Aluminum alloys) (MLRA 9:7)

Livanov, V. A.

137-1958-2-2683

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 69 (USSR)

AUTHORS: Mal'tsev, M.V., Livanov, V.A., Kuznetsov, K.I., Glazov, V.M.

TITLE: Modifying the Structure of Ingots of Industrial Aluminum Alloys (Modifitsirovaniye struktury slitkov promyshlennykh alyuminiyevykh splavov)

PERIODICAL: V sb.: Metallurg. osnovy lit'ya legkikh splavov. Moscow, Oborongiz, 1957, pp 140-154

ABSTRACT: A detailed study was made of the effect had by modification on the mechanical and technical properties of Al alloys. Tested were a D16 (aircraft Duralumin) alloy composed of 4.5 percent Cu, 1.52 percent Mg, 0.6 percent Mn, 0.15 percent Fe, and 0.25 percent Si and an AMts (aircraft aluminum) alloy composed of 1.62 percent Mn, 0.26 percent Fe, and 0.2 percent Si, the rest being Al. The alloys were prepared from industrial Al waste (mark AO), electrolytic Cu, Mg, and an Al-Mn alloying element. Ti was added as the modifying agent. The smelting was done in an SAN-type electric furnace with a capacity of up to 2,000 kg. The ingots were semicontinuous-cast. The basic tests were made on round ingots 170 mm in diameter. The following emerged from

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137-1958-2-2683

Modifying the Structure of Ingots of Industrial Aluminum Alloys

the tests: 1) the most intensive size reduction of the grain was observed with Ti concentrations of 0.05 - 0.1 percent; for better assimilation of the Ti by the alloy the former had to be introduced as a diluted alloying element (with a 3-4 percent Ti content) at the beginning of smelting, along with the basic charge; it was not desirable to superheat the modified alloy to temperatures > 740-760°; 2) as a result of the double smelting the Ti content dropped by more than 0.01 percent; 3) the modification interfered to some degree with liquation within the ingot; 4) the greatest improvement in the mechanical properties was observed when Ti concentrations were such as to produce maximum size reduction of the grain (i.e., 0.07 - 0.1 percent).

G.S.

1. Aluminum alloys--Modification

Card 2/2

LIVANOV, V. A. and YELAGIN, V. I. (Cand. Tech. Sci.)

"The Extrusion Effect at Elevated Temperatures." In book - Physical Metallurgy and Technology of Heat Treatment. Moscow, Oborongiz, 1958, 179 p.

An investigation of the "extrusion effect" (increased strength as a result of the extrusion process) in aluminum-magnesium alloys with additions of chromium and manganese (together and separately) shows that these alloys retain their increased strength evan after cold drawing. It is further shown that the extrusion effect is preserved at elevated temperature (300° C) and is observed both in the short-time strength test and in the long-time hardness test. There are 10 references, of which 8 are Soviet and 2 German.

LIVANOV, V. A. and YELAGIN, V. I. (Cand. Tech. Sci.)

"Investigation of k AMg6 Heat-resistant Alloy with Additions of Iron and Niclel." In book - Physical Metallurgy and Technology of Heat Treatment. Moscow, Oborongiz, 1958, 179.

The authors investigation shows that small additions of iron (0.008-09%) and nickel (0.17-0.72%) do not improve the mechanical properties of AMg6 alloy (al - 6% Mg) at elevated temperatures. There are 7 references, of which 5 are Soviet, 1 is English, and 1 German.

LIVANOV, V. A. (Cand. Tech. Sci.) VOZDVIZHENSKIY, V. M. (Cand. Tech. Sci.)

"Recrystallization of Aluminum-Manganese Alloys." In book- Physical Metallurgy and Technology of Heat Treatment. Moscow, Oborongiz, 1958. 179 p.

The authors study the recrystallizaton process of aluminum-manganese alloys are affected by the amount of manganese in solid solution, the quantity and distribution of dispersed phases, and nonuniformity of chemical composition and structure. There are 18 references of which 8 are Soviet, 8 English, and 2 German.

LIVANOV, V. A. VOZDVIZHENSKIY, V. M.

"Effect of Addition Elements on the Solubility of Manganese in Alumimum." In book-Physical Metallurgy and Technology of Heat Treatment. Moscow. Oborongiz, 1958. 179 p.

The authors study the effect of small amounts of iron, silicon, and titanium on the solubility of manganese in aluminum. There are 15 references, of which 3 are Soviet, 8 English, and 4 German.

LIVANOV, V.A.

P4 PHASE I BOOK EXPLOITATION 1017

Vsesoyuznaya konferentsiya po legkim splavam. 2d, Moscow, 1955

Legkiye splavy, [vyp. I] Metallovedeniye, termicheskaya obrabotka, lit'ye i obrabotka davleniyem; [osnovnyye doklady konferentsii] (Light Alloys. no. 1: Physical Metallurgy, Heat Treatment, Casting, and Forming; Principal Reports of the Conference), Moscow, Izd-vo AN SSSR, 1958. 497 p. 3,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii, USSR. Ministerstvo aviatsionnoy promyshlennosti.

Resp. Ed.: Fridlyander, I.N., Candidate of Technical Sciences; Eds. of Publishing House: Rzheznikov, V.S. and Chernov, A.N.; Editorial Board of set: Petrov, D.A., Doctor of Technical Sciences, Professor, Belov, A.F.; Drits, M.Ye., Candidate of Technical Sciences; Livanov, V.A., Candidate of Technical Sciences; Sharov, M.V., Candidate of Technical Sciences; Korneyev, N.I., Doctor of Technical Sciences, Professor.

Card 1/8

PURPOSE: This book is intended for metallurgists, machine designers, and other scientific and industrial personnel, as well as for faculty members and students of vuzes.

COVERAGE: The articles in the book contain new information on such subjects as the effect of alloying elements on the strength and heat resistance of aluminum- and magnesium-base alloys, structural modification of alloys for the improvement of their properties, controlling the structure and properties of alloys by regulating the conditions under which the alloys are made, and certain aspects of the casting, heat treatment, and forming of light metals. The book is also concerned with the development of new light alloys, the production of semifinished products, and with the present state and future development of the casting and forming of light alloys. No personalities are mentioned.

TABLE OF CONTENTS:

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000930220019-5"

SOV/137-58-10-21658

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 10, p 173 (USSR)

AUTHORS: Livanov, V.A., Shilova, Ye.I., Golokhmatova, T.N., Nikitayeva, O.G.

TITLE: Methods of Hardening Aluminum Alloys Intended for Operation at Elevated Temperatures (Puti uprochneniya alyuminiyevykh splavov dlya raboty pri povyshennykh temperaturakh)

PERIODICAL: V sb.: Legkiye splavy. Nr 1. Moscow, 1958, pp 88-122

ABSTRACT: Investigations were performed in order to determine the effect of various degrees of cold hardening, as well as of conditions of artificial aging (AA), on the mechanical properties of sheets of D16 alloy (A) at room temperature and at elevated temperatures. The initial material consisted of hot-rolled sheets of the D16 A which had been tempered only, or were tempered and subjected to natural aging for a period of five days; the sheets of the A were work-hardened by means of rolling with reductions equivalent to 5, 10, 15, 20, 25, and 30%. AA of work-hardened sheets, as well as sheets which have not been so treated, was accomplished at temperatures of 150, 170, 190, and 200°C, the soaking time being 6, 8, 10, and 12

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Methods of Hardening Aluminum Alloys (cont.)

hours, respectively. Optimal AA conditions, established on the basis of studies of properties of the A's at room temperature, were maintained during tests at elevated temperatures. The laws governing the changes occurring in the properties of the A relative to the temperature of AA are identical both at room temperature and at elevated temperatures. Specimens which have been aged at 170-180° possess maximal values of $\sigma_s$ and $\sigma_b$, but exhibit very low values of $\delta$. At lower temperatures of AA (130-150°), the strength characteristics of the A's are somewhat impaired, but the $\delta$ values are increased. Conducting the AA at a temperature of 190-200° results in a lowering of all mechanical properties of the A. It has been established that the strength of tempered and naturally aged D16 A is favorably affected by work hardening at temperatures of 100-200°. Work hardening (5-20% reduction) increases the $\sigma_b$ of sheets of the D16 A by as much as 10-15% at a temperature of 100° and by 13-18% at a temperature of 150°. Optimal conditions for processing of sheets of D16 consist of tempering operations and work hardening by means of rolling with reductions of 5-20% followed by AA (130-150° for 10-20 hours). Problems on the nature of hardening of an A by means of mechanical working of it after the operations of tempering and prior to the process of AA are discussed. 1. Aluminum alloys--Herdening

Card 2/2 1. Aluminum alloys--Temperature factors E.K.

18(7),18(6)

AUTHORS: Livanov, V. A., Bukhanova, A. A., Kolachev, B. A.

SOV/163-58-4-44/47

TITLE: Influence of Hydrogen on the Mechanical Properties of Titanium and Its Alloys (Vliyaniye vodoroda na mekhanicheskiye svoystva titana i yego splavov)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1958, Nr 4, pp 248-254 (USSR)

ABSTRACT: This investigation concerned the kinetics of the interaction of titanium and its alloys with hydrogen, as well as the influence of hydrogen on the mechanical properties of titanium and its alloys, using domestic technically pure titanium as starting material. For the time being, the investigation was restricted to the influence of hydrogen on the mechanical properties of titanium and its alloys in the form of smooth specimens with medium rates of deformation at room temperature. Technically pure titanium and its alloys VT-3, VT-3-1, VT-6, VT-5-1 were investigated. The first three alloys are $\alpha + \beta$ alloys, the last is an $\alpha$-titanium alloy.- The investigations showed that all four alloys absorb the hydrogen more intensely than the technically pure titanium. This seems to be caused by the smaller diffusion rate of hydrogen in titanium in the

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presence of alloying components. The strength characteristics of the technically pure titanium depend, in a wide range of concentration, very little on the hydrogen content, while the stretching and transverse contraction decrease with an increase in hydrogen content. But in the ranges corresponding to real conditions of production, the limit of strength, the flow limit, the stretching, and the transverse contraction are virtually independent of the hydrogen content. The notch impact strength changes little up to 0.015% $H_2$, but then falls suddenly down to very low values.- The behavior of the two alloy groups was different. A microstructure analysis was carried out to explain the strong differences. The causes are shown here for such different behavior. There are 5 figures, 2 tables, and 10 references, 2 of which are Soviet.

ASSOCIATION: Moskovskiy aviatsionnyy tekhnologicheskiy institut (Moscow Air Technological Institute)

SUBMITTED: October 5, 1957

LIVANOV, V.A., kand.tekhn.nauk; VOZDVIZHENSKIY, V.M., kand.tekhn.nauk

Recrystallization of aluminum-manganese alloys. Trudy MATI no.31: 65-83 '58. (MIRA 11:7)
(Aluminum-manganese alloys--Metallography)
(Solidification)

LIVANOV, V.A., kand.tekhn.nauk; VOZDVIZHENSKIY, V.M., kand.tekhn.nauk

Effect of additions on the solubility of manganese in aluminum. (MIRA 11:7)
Trudy MATI no.31:84-99 '58.
(Aluminum-manganese alloys) (Solutions, Solid)
(Solutions, Solid) (Phase rule and equilibrium)

LIVANOV, V.A., kand.tekhn.nauk; YELAGIN, V.I., kand.tekhn.nauk

Investigating the heat resistance of AMg6 alloys with iron and nickel additions. Trudy MATI no.31:138-142 '58. (MIRA 11:7)
(Aluminum-manganese alloys--Testing) (Heat-resistant alloys)

LIVANOV, V.A.; GOLOKHMATOVA, T.N.; PASTUKHOVA, G.A.

Use of high temperature homogenization in the manufacture of large, aluminum alloy, press-worked shapes. Issl.splav.tsvet. met. no.2:72-83 '60. (MIRA 13:5)
(Aluminum alloys--Heat treatment) (Sheet-metal work)

ROZHKOV, V.M.; SHOFMAN, L.A.; ROZANOV, B.V.; KUZ'KO, Yu.P.; PONGIL'SKIY, N.F.; LIVANOV, V.A.; LUCHIN, V.V.; KUZNETSOV, K.I.; TSYPER, V.A.; CHERNOSHTAN, V.K.

Points for pipe presses. Biul.TSIICHM no.9:52 160 (MIRA 15:4)
(Pipe mills--Equipment and supplies)

23015

1.9600 also 2408, 1418, 1413

S/536/60/000/043/006/011
E021/E435

AUTHORS: Livanov, V.A., Professor, Yelagin, V.I., Candidate of Technical Sciences and Shteyninger, V.R., Engineer

TITLE: Study of Wrought Alloys of the Al-Mg System With Additions of Manganese and Chromium

PERIODICAL: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy. No.43. 1960. pp.68-85. Termicheskaya obrabotka i svoystva stali i legkikh splavov

TEXT: A study of the influence of manganese and chromium additions to aluminium alloys containing 6 to 9% magnesium on the mechanical properties at room and elevated temperatures has been carried out. The aim was to determine the optimum total quantity and the optimum ratio of the manganese and chromium contents. Table 2 shows the alloys tested. Billets of the alloys were cast by continuous casting at 280 mm/min. The casting temperature was 690 to 700°C. 50 mm were cut from both ends and rejected. The billets were homogenized at 480°C for 36 hours. They were machined, hot rolled to 6 mm thickness, annealed and cold rolled to 1.8 mm. Tensile tests were carried out at room and elevated temperatures. All the samples tested were annealed at 350°C for

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Study of Wrought Alloys ...

1 hour and air cooled. The obtained results are tabulated and these were used to plot the effect of manganese and chromium contents on the mechanical properties for Mn + Cr contents of 0.8, 0.6 and 0.4%. The additions of manganese and chromium together have a greater effect than additions of the elements taken singly. When the total Mn + Cr content is 0.8%, the highest tensile strength at all temperatures is given by alloys containing 0.7% Mn and 0.1% Cr. The highest strength is shown by the alloy containing 9% Mg. The proof strength is less affected than the tensile strength but the best properties are obtained from alloys containing 0.6 to 0.7% Mn and 0.1 to 0.2% Cr. For a total Mn + Cr content of 0.6%, the highest tensile strength was obtained for alloys containing 0.5 to 0.4% Mn and 0.1 to 0.2% Cr. When the total Mn + Cr content is 0.4%, the difference in properties of the alloys containing from 0.4% Mn to 0.4% Cr is small. Microstructures are reproduced for alloys containing 7.5% Mg and 0.6% Mn + Cr. Alloys with up to 0.2% Cr consist of α solid solution, eutectic in the dendrite boundaries and in all probability small quantities of particles of manganese or chromium-manganese chemical compounds. In the alloy with 0.3% Cr, primary crystals of

chromium-manganese appear. The number of these crystals increases with increase in chromium content. Fig.6 shows the effect of increasing Cr content on the lattice parameter of the solid solution in an alloy containing 7% Mg and 0.6% Mn + Cr (the continuous line is in the cast condition and the discontinuous line after homogenization). Fig.7 shows the change in micro-hardness for a similar alloy containing 7.5% Mg and 0.8% Mn + Cr, and Fig.8 is for an alloy containing 7.5% Mg and 0.6% Mn + Cr. The higher strength of the alloy containing 0.4% Mn and 0.2% Cr can be explained by the greater content of Mg and Mn in the solid solution. It is recommended that the alloys Al - 7.5% Mg - 0.4 to 0.6% Mn - 0.2% Cr and Al - 9% Mg - 0.2 to 0.4% Mn - 0.1% Cr should be subjected to further tests and should be tried in industrial conditions. There are 8 figures, 5 tables and 2 references: 1 Soviet-bloc and 1 non-Soviet-bloc.

S/536/60/000/043/008/011
E021/E435

AUTHORS: Livanov, V.A., Professor, Bukhanova, A.A., Candidate of Technical Sciences and Kolachev, B.A., Candidate of Technical Sciences

TITLE: The Interaction of Titanium With Moist Atmosphere and Air

PERIODICAL: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy. No.43. 1960. pp.91-99. Termicheskaya obrabotka i svoystva stali i legkikh splavov

TEXT: The kinetics of the interaction between titanium sponge of 2 types with moist atmosphere and the kinetics of extraction of volatile impurities in the process of vacuum roasting at various temperatures were studied. The chemical composition of the sponge (in %) was: ТГ2 (TG2): 0.3 Fe, 0.15 Si, 0.05 C, 0.07 Mg, 0.2 $O_2$, 0.03 $H_2$, 0.05 $N_2$, 0.07 Cl, remainder Ti; ТГ3 (TG3): 0.4 Fe, 0.2 Si, 0.07 C, 0.12 Mg, 0.519 $O_2$, 0.026 $H_2$, 0.397 N , 0.14 Cl, remainder Ti. A titanium electrode prepared from TG2 was also investigated. 12 to 13 g of the titanium was placed in a desiccator which had a beaker of water in the bottom. A moist atmosphere was obtained and the reaction was studied by

following the change in weight of the titanium using an analytical balance. A vacuum apparatus was used to study the kinetics of extraction from the sponge of absorbed moisture and other volatile impurities. The change in weight with time (in days) of the electrode and TG2 sponge is shown in Fig.2. The weight of the electrode (curve 1) increases more than that of the sponge (curve 4) from which it was prepared. The initial sponge absorbs less water vapour than the sponge preliminarily dried at 300°C (curve 3). The electrode preliminarily washed in hot water (curve 2) is less hygroscopic than the initial electrode. Fig.3 shows the increase in weight of sponge TG3 in a moist atmosphere (curves 1 and 2) and air (curve 3). Curve 1 is for the sponge in its initial condition and curve 2 after saturation with hydrogen and a vacuum treatment at 900°C. TG3 is more hygroscopic than TG2 but the hydrogen and vacuum treatment decrease its tendency to absorb moisture. The result is explained by the fact that there is more $MgCl_2$ on the surface of TG3 than on TG2. This is shown by the chemical analysis after boiling the sponge and the electrode (Table 2). When the electrode is pressed, more $MgCl_2$ is

uncovered on the surface. After removing the $MgCl_2$ from the surface, the ability of the sponge and electrode to absorb moisture decreases. Fig.4 shows the change in weight (decrease) with time (in hours) of TG2 and TG3 with gradually increasing temperature as the process of vacuum extraction proceeds. Fig.5 shows the quantity of moisture extracted from TG2 against time (in hours) during vacuum extraction. The quantity extracted is 0.0044% after 10 hours at 20°C. Raising the temperature to 115°C increases this to 0.0062%. Further increases in temperature have little effect. Fig.6 shows the change in weight against time (in hours) during vacuum extraction of the electrode at various temperatures. Increasing the temperature from 20 to 100 °C gives an increase in the amount extracted. Further increases in temperature lead to a decrease, indicating that at these temperatures interaction between the water vapour and the electrode occurs. Fig.7 shows the change in weight against time (in minutes) of TG3 during vacuum extraction. Increasing the temperature from 20 to 400°C increases the amount extracted. Fig.8 shows the change in weight of TG2 sponge and the electrode (bottom curve) during alternate saturation with water vapour and vacuum extraction at 100°C.
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18.8200 2808, 4016, 1418

S/536/60/000/043/009/011
E021/E435

AUTHORS: Livanov, V.A., Professor, Bukhanova, A.A., Candidate of Technical Sciences and Kolachev, B.A., Candidate of Technical Sciences

TITLE: The Influence of Hydrogen on the Mechanical Properties of Titanium and its Alloys With Various Straining Conditions

PERIODICAL: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy. No.43. 1960. pp.100-105. Termicheskaya obrabotka i svoystva stali i legkikh splavov

TEXT: The mechanical properties of titanium and its alloys were tested on smooth samples at room temperature with three rates of strain: 0.1 to 0.2 mm/min, 3 to 5 mm/min and 30 to 50 mm/min. Specimens tested were commercial titanium, α alloy ВТ5-1 (VT5-1) and two α + β alloys ВТ3-1 (VT3-1) and ВТ6 (VT6). Chemical analysis is given in Table 1. Samples were forged at 1000°C from billets made in a furnace with a consumable electrode. They were cooled in air and specimens were cut from them for testing. The specimens were treated in vacuo at 900°C for 6 hours and cooled in

The Influence of Hydrogen ...

the furnace, in order to remove the hydrogen. The mechanical properties are given in Table 2. The specimens were then saturated with hydrogen, the hydrogen content being determined from the change in weight and from the change in pressure of hydrogen in the system. The hydrogen in the samples after vacuum treatment was determined by the fusion method. Fig.1 to 4 show the influence of hydrogen on the mechanical properties of the alloys (Fig.1 - commercial Ti; Fig.2 - VT5-1; Fig.3 - VT3-1; Fig.4 VT6). The properties increase markedly with increase in strain rate. The plastic properties decrease considerably with increase in hydrogen content, especially the reduction in area. Alloy VT6 is not subject to hydrogen embrittlement even up to 0.05% $H_2$. This may be because there is no eutectoid decomposition of the β phase with decrease in temperature. There are 4 figures, 2 tables and 4 non-Soviet-bloc references. The references to English language publications read as follows: H.M.Burte, Metal Progress, 1955, No.5, p.115-120; E.J.Ripling, J.Metals, 1956, 8(II), No.8, p.907-913; R.I.Jaffee, D.A.Lenning, C.M.Graighead, J.Metals, 1956, 8(II), No.8, p.923-928.

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Livanov, V.A.

S/149/60/000/004/007/009

AUTHORS: Livanov, V.A., Kolachev, B.A., Gabidullin, R.M., Musatov, M.I.

TITLE: Distribution of Alloying Components in a Titanium Ingot Obtained by Using a Consumable Portion Electrode

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya, 1960, No. 4, pp. 137-144

TEXT: In the preparation of titanium ingots by the method of consumable electrodes, insufficient homogeneity of the composition and of the mechanical properties was observed over the length and cross section of the ingot. A more homogeneous electrode may be obtained by splitting the titanium sponge into portions and by adding the alloying elements to each portion. If their dimensions are sufficiently small in respect to the liquid pool, the non-uniform distribution of the components in the ingot may be reduced. It may also be decreased by the method of repeated remelting. However, the heterogeneity of the ingot obtained from a portion electrode, will depend, even after repeated remelting, on the ratio of the liquid pool volume to the portion volume. The authors investigated the distribution of alloying elements in an ingot obtained from a portion electrode and determined the permissible dimensions of the portion of the electrode. Formulae are derived

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S/149/60/000/004/007/009

Distribution of Alloying Components in a Titanium Ingot Obtained by Using a Consumable Portion Electrode

for: the distribution of the alloying component over the length of an ingot obtained from a portion electrode with a non-uniformly distrubuted component; the distribution of the alloying component over the length of a titanium ingot after repeated remelting; the distribution of the alloying component in an electrode containing layers of pure Ti and a pure component. Figure 3 shows the distribution of an alloying component (Al) along a BT-5 (VT-5) alloy ingot calculated by the derived formulae for a case when the volume of the liquid pool is six times greater than the volume of the portion. The distribution of alloying components is non-uniform in the length and in the cross section. The found equations are used to calculate the distribution of the components after repeated remelting and it is established that this process may produce a sufficiently homogeneous material even if the components are distributed non-uniformly in the initial portion electrode, if the ratio of the liquid pool to the portion volume is sufficiently high. To carry out the quantitative verification of the formulae derived, a titanium ingot was cast of an electrode in which 5 cm layers, containing besides Ti 25% Cr-Al alloy, were pressed between 35 cm titanium layers. The volume of the liquid pool was 1/3 of the volume of one portion. The portions consisted of an alloyed and an unalloyed layer. Figure 5 shows experimental and calculated curves of the distribu-

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Distribution of Alloying Components in a Titanium Ingot Obtained by Using a Consumable Portion Electrode

tion of Cr and Al over the ingot. They are in a satisfactory agreement. The considerable non-uniformity in the distribution of Cr and Al over the ingot is caused by the fact that the size of the portions is large in respect to the volume of the liquid pool. Calculations made with the use of the described equations show that satisfactory homogeneous ingots are obtained after second remelting, if the volume of the liquid pool exceeds by three or more times the volume of one electrode portion. In this case the deviation from the rated composition does not exceed ± 0.05. There are 1 diagram and 4 sets of graphs.

ASSOCIATION: Moskovskiy aviatsionnyy tekhnologicheskiy institut (Moscow Technological Aviation Institute) Kafedra metallovedeniya i tekhnologii termicheskoy obrabotki (Department of Metallography and Technology of Heat Treatment)

SUBMITTED: March 9, 1960

S/762/61/000/000/006/029

AUTHORS: Savitskiy, Ye.M., Livanov, V.A., Nuss, P.A., Burkhanov, K.S., Musatov, M.I., Simanchuk, A.D.

TITLE: Alloys of titanium with rare-earth metals.

SOURCE: Titan v promyshlennosti; sbornik statey. Ed. by S.G. Glazunov. Moscow, 1961, 85-89.

TEXT: The paper reports the results of phase-diagram (PD) determinations and mechanical tests (beginning in 1959) at the Institute of Metallurgy, AS USSR, of Ti alloys with the rare-earth metals (REM) lanthanum (La), cerium (Ce), neodymium (Nd), and Yttrium (Y), all of which serve as stabilizers of the Ti α phase. The alloys are all characterized by a peritectoid-type PD. In the Ti corner of ternary Ti-Al-La and Ti-Al-Ce it was shown that increased Al content reduced the solubility of La and Ce (at 600°C, with 5% Al, Ce solubility < 0.1%). Tests on the effect of REM additions on the high-temperature characteristics (HTC) of Ti alloys were performed on the two-phase α+β alloy BT3-1 (VT3-1) and the BT5-1 (VT5-1) single-phase α-Ti solid solution (SS). The effect of Ce, Mischmetal (MM), and $Ce_2O_3$ on VT3-1 were determined with 0.001, 0.01, and 0.1% Ce; 0.2% MM, and 0.01 and 0.1% $Ce_2O_3$. The effect of 0.1% Ce alone was determined on VT5-1. Ce and MM were introduced in the form of Al-Ce and Al-MM ligatures. Microadditions (0.001-0.01%) of Ce increased the tensile strength of Ti alloys at 500-600° by 25-30% with-

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out impairing its ductility. An addition of 0.2% MM increased the tensile strength of the Ti alloy by as much as did 0.01% Ce, but with an appreciable loss in ductility. Even 0.1% Ce did not lead to the formation of any new phase; no change in room-temperature (RT) characteristics was noted, and the improved HTC cannot be explained theoretically. Microadditions of $Ce_2O_3$ improve the HT tensile strength of the Ti alloy tested by 20-30%, but with some loss in ductility. Passing reference is made to Grant's tests (USA; no detail given) on the hardening-phase formation of a refractory Ce-oxide segregation from the solid solution. All REM additions improved the stress-rupture HTC of VT3-1: At 500°C and 40 kg/mm$^2$, VT3-1 - 20 hrs, with 0.2% MM - 150 hrs, with 0.1% $Ce_2O_3$ - 125 hrs, with 0.01% $Ce_2O_3$ - 180 hrs, with 0.001% Ce - 77 hrs. The guarantee period for this alloy, according to Engineering Specs, is 50 hrs. The work on the effect of on the HTC of Ti alloys continues. Verification of the favorable effect of Ce on the modulus of elasticity of Ti requires additional work. Addition of 0.1% Ce enhances the HT tensile strength of VT5-1; 0.25% Ce less so and at a loss in ductility. Tests of microadditions (0.001 and 0.01%) of Ce to VT5-1 are recommended. In stress-rupture tests at 500° and 30 kg/mm$^2$, rupture of VT5-1 occurred at 130 hrs. Identical tests with VT5-1 with Ce addition produced longer, widely scattered, rupture times up to 300 hrs; the scatter is attributed to nonuniform Ce distribution in the alloy. Additional tests with more uniform Ce distribution are planned to determine an optimal Ce content. There are 4 figures; no identified references. ASSOCIATION: None given.

S/137/62/000/005/147/150
A052/A101

AUTHORS: Livanov, V. A., Gorokhov, V. P., Golofayev, T. I., Malyavkina, V. P.

TITLE: Analysis of Al alloys on ARL quantometer

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 5, 1962, 6, abstract 5K37 (V sb. "Fotoelektr. metody spektr. analiza". Moscow, Oborongiz, 1961, 87-95)

TEXT: The data of studying the effect of certain factors on the working conditions of the quantometer and on the accuracy of the analysis are reported, as well as the results of the investigation of standards and samples selected for the analysis on the quantometer. Standards of Д16 (D16) and АМг 6 (AMg6) alloys were subjected at the same time to a chemical analysis and to an analysis on the quantometer. The results of the analysis on the quantometer, corresponding to those of the chemical analysis, were obtained at the height of 3 - 4 mm from the lower plane of the sample.

L. Vorob'yeva

[Abstracter's note: Complete translation]

Card 1/1

S/123/62/000/014/009/020
A004/A101

AUTHORS: Livanov, V. A., Yelagin, V. I., Shteyninger, V. R.

TITLE: The effect of the heating rate during annealing on the properties of the АМГ 7-1 (AMG 7-1) alloy

PERIODICAL: Referativnyy zhurnal, Mashinostroyeniye, no. 14, 1962, 29, abstract 14B167 (In collection: "Deformiruyemyye alyumin. splavy". Moscow, Oborongiz, 1961, 144 - 149)

TEXT: The mechanical and corrosion properties of the new high-strength AMG 7-1 alloy with the composition (in %): 7.28 Mg, 0.6 Mn, 0.13 Cr, 0.003 Be, 0.16 Fe, 0.10 Si, 0.016 Cu, 0.043 Zn, the rest being Al, which is under development, depend to a considerable extent on the heating conditions during the standard annealing procedure (350°C, 1 hour). Investigations were carried out to study the effect of the heating rate during heating together with the furnace, in putting the components in the preheated furnace and during heating in a saltpeter bath. It was found that with increasing the heating rate a breaking up of the grains takes place in the annealed specimens, while the mechanical properties

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The effect of the...

are improved. However, corrosion tests of the specimens under load showed that the breaking up of the grains has a negative effect on the corrosion resistance of the alloy, lowering the latter at the applied heating rates by several orders. There are 2 figures and 6 references.

V. Stasevich

[Abstracter's note: Complete translation]

Card 2/2

S/137/62/000/005/049/150
A006/A101

1.1500

AUTHORS: Livanov, V. A., Gabidullin, R. M., Donorskaya, L. P.

TITLE: Some peculiarities of obtaining AMr5B (AMg5V) and AMr6 (AMg6) alloy ingots

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 5, 1962, 31, abstract 5G198 (V sb. "Deformiruyemyye alyumin. splavy", Moscow, Oborongiz, 1961, 195 - 199)

TEXT: Flat AMg5V and AMg6 alloy ingots are cast by the continuous method through a crystallizer of 205 x 1,400 mm cross section, having slots in the narrow faces. The casting temperature is 670 - 680°C, the speed of drawing the ingots is 65 - 75 mm/min. The authors studied the effect of various components in the alloy upon the hot-brittleness of the ingot. To reduce hot-brittleness of alloys AMg5V and AMg6, it is necessary to maintain the ratio of Fe to Si content $>$ 1.5 and the Mn content in the alloy within 0.50 - 0.55%. To obtain high-quality ingot surfaces, it is sufficient to introduce 0.0001 - 0.0002% Be. To obtain ingots without coarse accumulations of intermetallic compounds, the Ti and

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S/137/62/000/005/049/150
A006/A101

Some peculiarities of...

V content in AMg6 and AMg5V alloys should be 0.02 - 0.05%.

G. Svodtseva

[Abstracter's note: Complete translation]

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18.1285 1416 1418 1454

30924
S/536/61/000/050/006/017
D217/D304

AUTHORS: Livanov, V.A., Professor, Bukhanova, A.A., and Kolochev, B.A., Candidates of Technical Sciences

TITLE: Influence of hydrogen on the structure and properties of the alloys BT 8(VT8) and BT10 (VT10)

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 52-60

TEXT: The influence of hydrogen on the mechanical properties of the $\alpha + \beta$ titanium alloy VT8 and of the $\alpha$-titanium alloy VT10 was studied at various rates of deformation. The specimens were cut from hot forged rods of 14 x 14 mm cross section. Sections from these were annealed in vacuo at 900°C for 6 hours and then saturated with hydrogen. The specimens were then furnace cooled. The hydrogen content was determined from the gain in weight of the specimens, as well as from the change in hydrogen pressure in the system. The hydrogen remaining in the specimens

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Influence of hydrogen ...

after vacuum annealing was determined by the melting method and included in the results obtained. The hydrogen-saturated specimens were tested for tensile strength and impact resistance. Tensile tests were carried out on smooth specimens at room temperature at three different deformation rates: (a) 0.1-0.2 mm/minute; (b) 3-5 mm/minute and (c) 30-50 mm/min. (3-5 mm/min. is the deformation rate normally used for commercial tensile testing). It was found that hydrogen, even if present in extremely small quantities(above 0.01%), seriously reduces the plastic properties of the $\alpha$-titanium alloy VT10, especially as regards high rates of deformation. The plastic properties of the $\alpha + \beta$ alloy VT8 in the presence of hydrogen decrease to a lesser extent than those of the former alloy, and even 0.05% hydrogen does not give rise to a serious reduction in plasticity. However, the ductile characteristics of this alloy at low deformation rates fall sharply when the hydrogen content exceeds 0.02 wt.%. There are 6 figures, 1 table and 3 references: 1 Soviet-bloc and 2 non-Soviet-bloc. The references to the English-language publications read as follows: H.M. Burte, Metal Progress, 1955, v. 66, no. 5, pp. 195-120; R.I. Jaffe, G.A. Lenning, C.M. Graighead, J. of Metals, 1956, no. 8, pp. 923-928.

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18.1285

3025
S/536/61/000/050/007/017
D217/D304

AUTHORS: Livanov, V.A., Professor, Bukhanova, A.A., and Kolachev, B.A., Candidates of Technical Sciences

TITLE: Influence of grain size on the hydrogen embrittlement of titanium and its alloys

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 61-70

TEXT: The main purpose of this paper was to investigate the influence of hydrogen on the mechanical properties of fine grained and coarse grained titanium and its alloys. Specimens of commercially pure titanium were made from forged rods and annealed in vacuo at 700°C, 900°C and 1100°C. Annealing at 700°C results in a fine-grained structure; at 900°C, medium-sized grains form, whilst at 1100°C the structure becomes coarse-grained. After vacuum annealing, the specimens were furnace-cooled. Various quantities of hydrogen were then introduced into them at the same temperatures at which vacuum annealing had been carried out.

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Influence of grain ...

Soaking time before and after saturation with hydrogen at the above temperatures was one hour in each case. The subsequent cooling was carried out in the furnace. The dependence of the mechanical properties of Ti on hydrogen content was studied after vacuum annealing at 1100°C and saturation with hydrogen at 1100°C and 900°C, and the microstructure of Ti saturated with hydrogen at various temperatures was compared with that of commercially pure Ti after vacuum annealing at the same temperatures. It was found that the coarse-grained metal had a greater tendency to hydrogen embrittlement than fine-grained material; this is due to differences in the nature of the hydride precipitates. In the fine-grained material, Ti hydrides separate along the grain boundaries in the form of compact, often formless, precipitates. In the coarse-grained material, Ti hydrides precipitate in the form of very fine platelets. This fine precipitate causes high stress concentrations and premature destruction of the metal. There are 8 figures.

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18.1285

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S/536/61/000/050/008/017
D217/D304

AUTHORS: Livanov, V.A., Professor, Buchanova, A.A. and Kolachev, B.A. Candidates of Technical Sciences

TITLE: Influence of hydrogen on the thermal stability of the alloy ВТ 3-1 (VT3-1)

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 71-81

TEXT: Specimens of alloy VT-3-1 were annealed in vacuo at 900°C for 6 hours. Mechanical tests were carried out after various isothermal annealing treatments on specimens of various hydrogen contents, at three different deformation rates: (a) 40 mm/minute (b) 4 mm/minute and (c) 0.1 mm/minute. After vacuum annealing, the microstructure of the VT3-1 alloy consists of a supersaturated $\alpha$-solid solution containing a small quantity of the $\beta$-phase. The structure of the alloy on being saturated with hydrogen immediately after vacuum annealing remains essentially unaltered. Isothermal annealing at 450°C for 48 hours leads to a

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Influence of hydrogen ...

decomposition of the supersaturated solution and to the precipitation of the $TiCr_2$ phase, by eutectoid decomposition of $\beta$. The higher the temperature, the greater the rate of eutectoid decomposition. It is found that isothermal annealing leads to embrittlement of the VT3-1 alloy which is the more pronounced the higher the annealing temperature. Embrittlement is noticeable only after isothermal annealing at 550°C for over 100 hours. Hydrogen lowers the thermal stability of the alloy. The brittleness of an alloy containing more than 0.03% hydrogen manifests itself even after annealing at 350°C for 100 hours. The decrease in thermal stability of a VT3-1 alloy containing hydrogen is due to the fact that the latter accelerates decomposition of the $\beta$-phase and of the supersaturated $\alpha$-solid solution. Besides, in the presence of hydrogen, Ti hydride or any other phase containing hydrogen, precipitation of phases other than $TiCr_2$ also occurs. Hydrogen lowers the thermal stability of the alloy VT3-1 to a lesser degree than that of the alloy VT3, since the $\beta$-phase in the former is more stable than in the latter. There are 7 figures and 3 references: 1 Soviet-bloc and 2 non-Soviet-bloc. The reference to the English-language publication reads

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S/536/61/000/050/008/017
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Influence of hydrogen ...

as follows: R.I. Jaffee, G.A. Lenning, C.M. Craighead, J. of Metals, 1956, no. 8, pp. 907-913.

X

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30927
S/536/61/000/050/009/017
D217/D304

18 1285

AUTHORS: Livanov, V.A., Professor, Buchanova, A.A., and Kolachev, B.A., Candidates of Technical Sciences

TITLE: Influence of oxygen and hydrogen on the structure and properties of titanium

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 82-92

TEXT: The combined influence of oxygen and hydrogen on the mechanical properties and structure of Russian commercially pure titanium was investigated. Ingots were melted in a laboratory arc furnace, using a soluble segmented electrode. The electrodes were compacted from sponge containing the following impurities: 0.1% Fe, 0.05% Si, 0.05% Mg, 0.05% Cl, 0.1% $SO_2$, 0.01% $H_2$, 0.03% $N_2$ and 0.03% Ni. Oxygen was added to each portion of the electrode in the form of calculated quantities of $TiO_2$. By this method, ingots with the following supplementarily added oxygen

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Influence of oxygen ...

contents were made: 0, 0.06, 0.1, 0.2, 0.3, 0.5 and 1.0 wt.%. After the first remelting, the ingots were ground and forged. The forged billets were then used as electrodes for the second remelting process. The ingots obtained by double remelting were forged into rods of 12 x 12 mm cross section at 980-1000°C. After hot forging, the rods were cooled in air and cut into sections for specimens for mechanical testing. The mechanical test specimens were vacuum annealed at 900°C for 6 hours, after which they were furnace-cooled. They were then saturated with hydrogen to various concentrations. The hydrogen content of the specimens was determined from the change in hydrogen pressure in a system of known volume, and from the gain in weight of the specimens. After being saturated with hydrogen, the specimens were furnace-cooled. Their mechanical properties were determined at room temperature. After testing, the microstructure of undeformed portions of the specimens was studied. The oxygen content of the alloys was determined by the equilibrium pressure of hydrogen introduced into it. It was found that the joint presence of oxygen and hydrogen in Ti greatly affects the structure and properties

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D217/D304

Influence of oxygen ...

of the latter. At low contents of these impurities (up to 0.3 wt.% $O_2$ and up to 0.03 wt.% $H_2$) hydrogen does not exert a noticeable influence on the strength of Ti, but seriously reduces the plasticity characteristics, particularly the impact resistance. At high oxygen contents, hydrogen sharply decreases the strength and plasticity of Ti. In amounts not exceeding 0.5-0.7 wt.%, oxygen sharply increases the U.T.S. and yield strength. 0.01 wt.% oxygen increases the U.T.S. and yield strength of Ti by 1.3 kg/mm$^2$. In the joint presence of $H_2$ and $O_2$ in Ti and its alloys, a Ti hydride precipitate appears. The latter is characterized by a greater degree of dispersion at greater oxygen contents of Ti. Oxygen does not appear to have a great influence on the solubility of hydrogen in $\alpha$-titanium at room temperature. There are 12 figures and 6 non-Soviet-bloc references. The 4 most recent references to the English-language publications read as follows: T.S. Liu, M.A. Steinberg, Transaction of the American Society for Metals, 1957, 50, Preprint no. 34; G.A. Lenning, C.M. Craighead, R.I. Jaffee, J. of Metals, 1954, v.6, p. 367; G. Weinig, J. of Metals, 1957, v. 9, no. 10; G.A. Lenning, J.W.

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S/536/61/000/050/009/017
D217/D304

Influence of oxygen ...

Spretnak, R.I., Jaffee, J. of Metals, 1956, v. 8, no. 10.

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18 1285

30928
S/536/61/000/050/010/017
D217/D304

AUTHORS: Livanov, V.A., Professor, Buchanova, A.A., and Kolachev, B.A., Candidates of Technical Sciences

TITLE: Hydrogen embrittlement of titanium-aluminum alloys

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 93-102

TEXT: The purpose of the present work was to investigate the influence of Al, one of the main alloying elements of many industrial Ti alloys, on the hydrogen embrittlement of Ti. To study the influence of Al on the mechanical properties and structure of Russian technically pure Ti in the presence of hydrogen, Ti-Al alloy ingots were made in a laboratory arc furnace, using soluble segmented electrodes. The electrodes were compacted from TiO sponge. Ingots containing 0, 3, 4, 7.5 and 10% Al were made. After the first remelting, the ingots were ground and forged. The forged billets were then used as electrodes for the second melting. The ingots obtained after repeated remelting were forged into rods of

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Hydrogen embrittlement ...

14 x 14 mm cross section at 1050°C. After hot forging, the rods were cooled in air and cut into sections for specimens for mechanical testing. The specimens were annealed in vacuo at 900°C for 6 hours, after which they were furnace cooled. They were then saturated with hydrogen to various concentrations and again furnace-cooled. Mechanical testing of the hydrogen-saturated specimens was carried out at room temperature. The microstructure was studied, using the undeformed portions of impact text pieces. It was found that Al reduces the tendency of Ti to hydrogen embrittlement; this is due to the increased solubility of hydrogen in the $\alpha$-solid solution and to the retardation of the diffusion of hydrogen in Ti in the presence of Al. The maximum permissible hydrogen content of a Ti alloy containing 5% Al (VT5) is approximately 0.03%, i.e. twice that permissible for commercially pure Ti. There are 10 figures and 3 non-Soviet-bloc references. The references to the English-language publications read as follows: H.R. Ogden, D.I. Maykath, W.L. Finlay, R.I. Jaffee, J. of Metals, 1953, v. 5, no. 2, II, 267; G.A. Lenning, J.W. Spretnak, R.I. Jaffee, J. of Metals, 1956, vo. 8, no. 10, II.

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S/536/61/000/050/011/017
D217/D304

AUTHORS: Livanov, V.A., Professor, Musatov, M.I., Engineer, and Kolachev, B.A., Candidate of Technical Sciences

TITLE: Distribution of alloying elements in a titanium ingot produced by melting with the soluble segmented electrode

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 103-116

TEXT: The main disadvantage of Ti ingots produced by arc melting with a soluble electrode is their inhomogeneity with respect to chemical composition. By mathematical calculations, it was found that a much more uniform distribution of alloy elements along the length and cross section of ingots could be obtained by melting with a soluble segmented electrode. The relative inhomogeneity of distribution of the alloying components in such an ingot depends essentially on the ratio between the volume of the active portion of the electrode and that of the molten bath. If the ratio between the molten bath volume and the electrode volume is

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Distribution of ...

sufficiently small ($V_{m.b.}/V_c < 1$), then a practically uniform distribution of alloying components along the length and cross section of the ingot will be obtained even after the first remelting process. On the other hand, if the volume of the molten bath is small, compared with that of the electrode ($V_{m.b.}/V_c > 1$), then a very inhomogeneous distribution will result which cannot be rectified even by repeated remelting. There are 9 figures and 1 Soviet-bloc reference.

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PHASE I BOOK EXPLOITATION SOV/6171

Livanov, Vladimir Aleksandrovich, Anna Arkhipovna Bukhanova, and Boris Aleksandrovich Kolachev

Vodorod v titane (Hydrogen in Titanium). Moscow, Metallurgizdat, 1962. 244 p. Errata slip inserted. 2900 copies printed.

Ed.: L. P. Luzhnikov; Ed. of Publishing House: M. S. Arkhangel'skaya; Tech. Ed.: L. V. Dobuzhinskaya.

PURPOSE: This book is intended for scientific workers, engineers, and technicians at plants and scientific research institutes engaged in the production, treatment, and application of titanium and its alloys. It may also be useful to aspirants and senior students at schools of higher technical education, who specialize in physical metallurgy, technology of heat treatment, casting, forming, and welding of metals. It may likewise be of interest to design engineers.

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Hydrogen in Titanium SOV/6171

COVERAGE: The book deals with the interaction of titanium with hydrogen and water vapor. Equipment used for investigating this interaction is described. Behavior of hydrogen in the arc melting and vacuum degassing of titanium is also discussed. Particular attention is given to the effect of hydrogen on the structure and mechanical properties of titanium and its alloys, thermal stability of alloys, and their susceptibility to crack formation. The mechanism of hydrogen embrittlement of titanium and its alloys and methods of preventing it are dealt with at length. The authors thank M. A. Vershkov, P. A. Nuss, L. A. Shelkova, N. V. Il'ichev, I. V. Kashkin, Ye. I. Dukhanova, N. Ya. Gusel'nikov, L. P. Luzhnikov, and V. I. Mikheyev for their assistance. There are 145 references, Soviet and non-Soviet.

TABLE OF CONTENTS:



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TROSTYANSKAYA, Ye.B.; SHISHKIN, V.A.; SIL'VESTROVICH, S.I.; PANTELEYEV, A.S.; POLUBOYARINOV, D.N.; BALKEVHICH, V.L.; NATANSON, A.K.; KOLACHEV, B.A.; PETROV, D.A.; GOL'DBERG, M.M.; SHAROV, M.Ya., inzh., retsenzent; KITAYGORODSKIY, I.I., doktor tekhn. nauk, prof., retsenzent; LIVANOV, V.A., kand. tekhn. nauk, prof., retsenzent; TROSTYANSKAYA, Ye.B., red.; BABUSHKINA, S., ved. red.; TITSKAYA, B.F., ved. red.; VORONOVA, V.V., tekhn. red.

[New kinds of materials in engineering and industry]Novye materialy v tekhnike. Pod red. Trostianskoi E.B., Kolacheva, B.A., Sil'vestrovicha S.I. Moskva, Gostoptekhizdat, 1962. 656 p. (MIRA 16:2)
(Materials)

LIVANOV, V.A.; YELAGIN, V.I.; EKHINA, Ye.V.

Effect of conditions of heat treatment and susceptibility to corrosion under stress and the mechanical properties of aluminum-magnesium alloys with a high magnesium content. Issl. splav. tsvet. met. no.3:169-180 '62. (MIRA 15:8)
(Aluminum-magnesium alloys--Corrosion)
(Metals, Effect of temperature on)

KUMARIN, A., starshiy prepodavatel'; PLAKSIN, V.; LEVIN, S.; LIVANOV, V.

New forms of the organization of technical control. Sots. trud 7 no.9:79-85 S '62. (MIRA 15:9)

1. Kuybyshevskiy planovoy institut (for Kumarin). 2. Nachal'nik otdela tekhnicheskogo kontrolya Chetvertogo ordena Lenina podshipnikovogo zavoda (for Plaksin). 3. Nachal'nik otdela tekhnicheskogo kontrolya Kuybyshevskogo zavoda avtotraktornogo elektrooborudovaniya i karbyuratorov (for Levin). 4. Nachal'nik otdela tekhnicheskogo kontrolya Devyatogo podshipnikovogo zavoda im. V.V.Kuybysheva (for Livanov).
(Kuybyshev Province--Machinery industry--Quality control)

S/048/62/026/007/018/030
B104/B138

AUTHORS: Livanov, V. A., Gorokhov, V. P., Golofayev, T. I., and Malyavkina, V. P.

TITLE: Analysis of aluminum alloys with the multichannel ARL quantometer

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Seriya fizicheskaya, v. 26, no. 7, 1962, 914-918

TEXT: The ARL quantometer was tested and was found rapid and accurate. As the instrument has no arrangements for the rapid transport and treatment of samples, nor for the supply of information, the advantages of rapid operation are, however, partly lost. Laboratory staff could be reduced by automating the analysis. To improve the accuracy and stability of analysis on copper and magnesium present in large amounts, better quality must be used. There are 2 figures and 4 tables.

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LIVANOV, V.A.

ACCESSION NR: AT4014061 S/3072/63/000/000/0066/0069

AUTHOR: Veyler, S. Ya.; Likhtman, V. I.; Petrova, N. V.; Vasil'yeva, Ye. N.; Basova, I. G.; Kuznetsov, K. I.; Livanov, V. A.

TITLE: Effect of cooling and lubricating fluids upon the quality of the sheet surface during rolling of aluminum alloys

SOURCE: Fiz.-khim. zakonomernosti deystviya smazok pri obrabotke metallov davleniyem. Moscow, Izd-vo AN SSSR, 1963, 66-69

TOPIC TAGS: aluminum, aluminum alloy, aluminum sheet, aluminum rolling, sheet rolling, cooling fluid, lubricating fluid, emulsol

ABSTRACT: The normal water-emulsion lubricants used during the rolling of aluminum alloys prove unsatisfactory under technological conditions because they produce water stains on the surface of the rolled metal and become impure after a few days of service. Therefore,

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ACCESSION NR: AT4014061

In the present work, a new improved type of lubricant has been developed to prevent the formation of surface failures. Also, a procedure for regenerating the emulsion has been worked out. Emulsol, containing 84% kerosene, 10% oleic acid and 6% triethanolamine, was tested and proved satisfactory as a lubricant. Especially good results were obtained with a lubricant emulsion containing 30-40% of the above-mentioned emulsol. Using this lubricant, the surface of the rolled aluminum sheet became smooth, brighter and free of surface defects, and rolling was simplified. This lubricant was also used successfully in the cold extrusion of aluminum tubes as well as in the cutting of aluminum and its alloys. The service life of the emulsion was prolonged up to six months. Desalting with sodium chloride, calcium chloride and karnalit and separating the sedimented emulsion was found to be an effective method for regenerating the emulsion. Orig. art. has: 1 chemical equation.

ASSOCIATION: none

SUBMITTED: 00 DATE ACQ: 19Dec63 ENCL: 00

SUB CODE: MM NO REF SOV: 002 OTHER: 005

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LIVANOV, V.A.; KOLACHEV, B.A.

Classification of titanium alloys according to their structure. Titan i ego splavy no.10:55-62 '63. (MIRA 17:1)

ACCESSION NR: AT4007044 S/2598/63/000/010/0218/0223

AUTHOR: Livanov, V. A.; Kelesh'yan, N. M.; Faynbron, S. M.; Ryabova, R. M.

TITLE: Composition and properties of production heats of AT-3 titanium alloys

SOURCE: AN SSSR. Institut metallurgii. Titan i yego splavy*, no. 10, 1963. Issledovaniya titanovy*kh splavov, 218-223

TOPIC TAGS: AT-3 titanium alloy, titanium alloy, AT-3 alloy structure, AT-3 alloy property, forged AT-3 titanium alloy, cast AT-3 alloy, extruded AT-3 alloy, AT-3 alloy heat resistance, complex titanium alloy, titanium aluminum alloy

ABSTRACT: Mechanical properties and cross-sectional macro- and microstructure have been investigated in cast, forged, and extruded specimens of high-quality AT-3 alloy containing Al, Cr, Fe, and Si. The macrostructure of the AT-3 alloy showed a fine, uniform grain size under all test conditions. With increases in temperature of the forging and extrusion processes, the structure was affected only slightly. The mechanical properties of the tested alloy were uniform and stable, although in rods with diameters of 160, 100, and 65 mm some anisotropy was found. This anisotropy can be explained by the occurrence of some inclusions

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ACCESSION NR: AT4007014

distributed along the direction of deformation of the metal. These inclusions in longitudinal specimens did not affect the mechanical properties of the alloy but markedly decreased the metal strength in the cross sections. The microstructure of the AT-3 alloy was an α-solution under all tested conditions. The AT-3 alloy is thermally stable in the interval 400-450 C, does not become brittle after 100 hours of exposure, and shows high and long-lasting heat resistance. "V. S. Mikheyev and S. Ye. Ivanova also took part in the work." Orig. art. has: 6 figures.

ASSOCIATION: Institut metallurgii AN SSSR (Metallurgical Institute, AN SSSR)

SUBMITTED: 00 DATE ACQ: 27Dec63 ENCL: 00

SUB CODE: ML, MA NO REF SOV: 000 OTHER: 000

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ACCESSION NR: AT4007054 S/2598/63/000/010/0307/0316

AUTHOR: Livanov, V. A.; Bukhanova, A. A.; Kolachev, B. A.; Gusel'nikov, N. Ya.

TITLE: Hydrogen embrittlement of titanium alloys

SOURCE: AN SSSR. Institut metallurgii. Titan i yego splavy*, no. 10, 1963. Issledovaniya titanovy*kh splavov, 307-316

TOPIC TAGS: titanium alloy, VT-3-1 titanium alloy, titanium alloy embrittlement, titanium alloy hydrogen embrittlement, hydrogen embrittlement, VT-3-1 alloy embrittlement, VT-4 titanium alloy, VT-5 titanium alloy, VT-10 titanium alloy

ABSTRACT: It has been stated that hydrogen exerts a detrimental effect on the mechanical properties of titanium and its alloys. Introduction of small quantities of hydrogen into titanium and its alpha alloys drastically reduces their impact strength. Unlike alpha alloys, the alpha-beta alloys do not exhibit hydrogen embrittlement during impact ductility tests, but only in tests at small strain velocities. Hydrogen embrittlement of the alpha-beta alloy VT-3-1 and of the alpha alloys VT-4, VT-5, and VT-10 was studied by the authors at various hydrogen concentrations (0.002 — 0.05%) and strain velocities (0.1 — 4 mm/min), and after different heat and natural aging treatments. The mechanical

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ACCESSION NR: AT 4007054

properties measured in the tests conducted by the authors are the ultimate tensile strength, yield strength, specific elongation, and contraction of cross-sectional area of the test specimen. It was concluded that: (1) Alpha-beta alloys exhibit hydrogen embrittlement at low strain velocities and this embrittlement is assisted by low temperature and by the presence of notches. (2) A certain minimum hydrogen content is required for the development of alpha-beta alloy embrittlement. After standard heat treatment alloy VT-3-1 exhibits hydrogen embrittlement at a hydrogen content exceeding 0.03%; after quenching, however, alloy VT-3-1 shows hydrogen embrittlement at 0.01%. This embrittlement is accompanied by a reduction of plasticity and an increase of tensile strength. The decrease of plasticity appears, not immediately after quenching, but in the process of natural aging after quenching. (3) Titanium-base alpha alloys VT-4, VT-5, and VT-10 like the alpha-beta alloys, exhibit hydrogen embrittlement at low strain velocities. This can be explained by a regrouping of hydrogen under the influence of stresses. Consequently, it is necessary to revise the existing mechanism explaining the brittle fracture of alpha-beta alloys caused by hydrogen. It has been suggested that hydrogen embrittlement of alpha-beta alloys is caused by processes developing in both alpha and beta phases: hydrogen diffuses toward microdefects or grain boundaries where a formation of microvolumes enriched with hydrogen takes place; at hydrogen concentra-

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ACCESSION NR: AT 4007054

tions above a certain limit microfissures begin to develop in the microvolumes and lead to the failure of a manufactured item. Orig. art. has: 7 figures and 1 table.

ASSOCIATION: Institut metallurgii AN SSSR (Metallurgical Institute AN SSSR)

SUBMITTED: 00 DATE ACQ: 27Dec63 ENCL: 00

SUB CODE: MM NO REF SOV: 005 OTHER: 004

Card 3/3

ACCESSION NR: AT4007058 S/2598/63/000/010/0345/0356

AUTHOR: Livanov, V.A.; Mikheyev, V.S.; Faynbron, S.M.; Kutsenko, A.A.; Ivanova, S.Ye.

TITLE: Tensile and rupture strength of the six-component titanium alloys AT-3, AT-4, AT-6 and AT-8

SOURCE: AN SSSR. Institut metallurgii. Titan i yego splavy*, no. 10, 1963. Issledovaniya titanovy*kh splavov, 345-356

TOPIC TAGS: titanium alloy, AT-3 titanium alloy, AT-4 titanium alloy, AT-6 titanium alloy, AT-8 titanium alloy, titanium alloy mechanical property, alloy rupture strength, complex titanium alloy, titanium alloy property, titanium alloy heat resistance, titanium aluminum chromium alloy, iron containing alloy, silicon containing alloy, boron containing alloy

ABSTRACT: This study concerns the mechanical properties and high temperature strength of titanium alloys AT-3, AT-4, AT-6 and AT-8. Specimens were taken from two different production lots with varying contents of Al, Cr, Fe, Si and B. They were prepared from forged rods (14 x 14 mm), and subjected to preliminary tempering at 850, 900 and 950C. Tensile strength was tested at temperatures ranging from 20 to 700C (see Fig. 1 in the

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ACCESSION NR: AT4007058

Enclosure). In addition, the authors considered the effects of forging procedures on mechanical properties (see Fig. 2 in the Enclosure). Rupture strength was tested at temperatures of 400-600C and loads of 15-55 kg/mm$^2$ (results are tabulated), taking into consideration the effect of varying aluminum contents (see Fig. 3 in the Enclosure). The authors conclude that AT titanium alloys with 3-7.5% Al and a combined Cr-Fe-Si content of 1.5-1.8% exhibit high tensile strength (80-90 kg/mm$^2$ for AT-3 at room temperature, 90-105 for AT-4, 105-115 for AT-6 and 115-125 for AT-8). The plastic properties deteriorate as the Al content increases (14-15% elongation and 51-53% cross-section shrinkage for AT-3, 11-13% and 38%, respectively for AT-8). The rupture temperature rises as the Al content increases (450C for AT-3 to 550C for AT-8). The high temperature strength was good. The tempering temperature affects the duration of rupture strength tests. In view of their mechanical properties at room and high temperatures and their high temperature strength, the alloys named are suitable for wide use in modern technology. Orig. art. has: 4 tables and 4 graphs.

ASSOCIATION: Institut metallurgii AN SSSR (Institute of metallurgy, AN SSSR)

SUBMITTED: 00 DATE ACQ: 27Dec63 ENCL: 04

SUB CODE: ML NO REF SOV: 002 OTHER: 000

Card 2/2

L 14321-65 EWT(m)/EWP(b)/EWP(t) ASD(m)-3/IJP(c) JD/MLK
ACCESSION NR: AT4048052 S/0000/64/000/000/0054/0057

AUTHOR: Kolachev, B. A.; Livano, V. A. B

TITLE: The relationship of the structures arising during quenching of titanium alloys to structural equilibrium curves 27

SOURCE: Soveshchaniye po metallurgii, metallovedeniyu i primeneniyu titana i yego splavov. 5th, Moscow, 1963. Metallovedeniye titana (Metallography of titanium); trudy* soveshchaniya. Moscow, Izd-vo Nauka, 1964, 54-57

TOPIC TAGS: alloy structure, alloy phase transformation, titanium alloy, quenching, phase diagram, martensite

ABSTRACT: Recently, many diagrams of the metastable phase composition of titanium alloys have been published, illustrating the structure of the alloys by showing phase composition as a function of temperature, but always after quenching. In principle, these diagrams have little to do with phase equilibrium curves unless the characteristics of the β-phase are already known and can be applied. In their consideration of alloys of titanium with a β-stabilizer, called a transition element, the authors neglect the formation of eutectoid compounds, since with titanium, they are formed only exceedingly slowly and have a negligible influence on the system after quenching. They also postulate that the concentration of

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L 14321-65
ACCESSION NR: AT4048052

elements in the β-phase is below the critical concentration for each temperature at which a martensite (α') reaction goes to completion (represented by line $M_H$ in Fig. 1 of the Enclosure). A line $M_K$ is constructed below which no martensitic transformation occurs. They then pick two temperatures, $T_1$ and $T_2$: Below $T_1$ the concentration of the β-stabilizer in the β-phase is above critical and there is no martensitic transformation; above $T_2$ no β-phase remains. Lastly, two concentrations of β-stabilizer are selected, $C_1$ and $C_2$: Below $C_1$ only the martensitic reaction occurs; above $C_2$ there is enough β-stabilizer to complete the transformation to the β-phase. Comparison of the suggested metastable diagrams in Figs. 1 and 2 of the Enclosure demonstrates a marked degree of agreement with the experimentally constructed ones in the literature. Furthermore, these permit a more exact interpretation of the experimental data. Orig. art. has: 5 graphs.

ASSOCIATION: none

SUBMITTED: 15Jul64 ENCL: 01 SUB CODE: MM

NO REF SOV: 006 OTHER: 000

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L 14321-65
ACCESSION NR: AT4048052

ENCLOSURE: 01

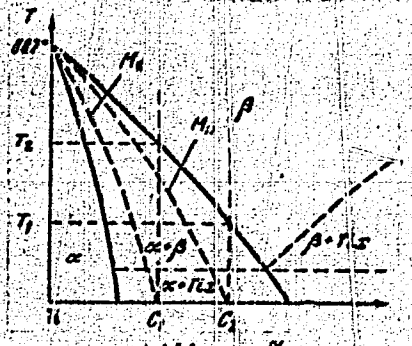


Fig. 1. Schematic diagram of the composition of titanium alloys with a transition element.

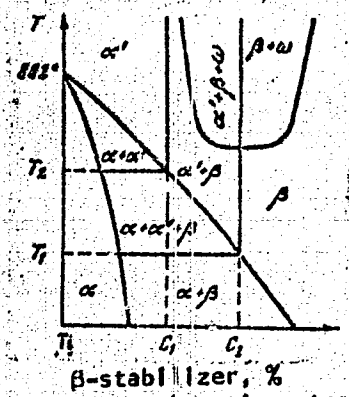


Fig. 2. Schematic metastable diagram of the phase composition of titanium alloys with a high degree of purity.

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L 14318-65 EWT(m)/EWP(b)/EWA(d)/EWP(w)/EWP(t) IJP(c)/ASD(m)-3 JD/MLK
ACCESSION NR: AT4048056 S/0000/64/000/000/0088/0094

AUTHOR: Kolachev, B.A., Livanov, V.A., Bukhanova, A.A.

TITLE: Dislocation theory of the hydrogen brittleness of titanium alloys

SOURCE: Soveshchaniye po metallurgii, metallovedeniyu i primeneniyu titana i yego splavov. 5th, Moscow, 1963. Metallovedeniye titana (Metallography of titanium); trudy* soveshchaniya. Moscow, Izd-vo Nauka, 1964, 88-94

TOPIC TAGS: dislocation theory, hydrogen brittleness, titanium alloy, titanium alloy brittleness, hydrogen atom mobility, brittleness temperature

ABSTRACT: The study concerns the reversible brittleness developing in typical $\alpha + \beta$ alloys at low deformation rates. It is assumed that at a temperature below some critical $T_0$ the hydrogen will form Kottrell atmospheres at the dislocations; if the deformation rate is low and temperatures so high that the mobility of the hydrogen atoms approximates the deformation rate, the dislocations will transport the atmospheres to the boundary of the grain; this will result in segregation of the hydrogen, facilitating degeneration and enlargement of the grooves. The mathematical basis is given by the Kottrell formula $v_0 = \frac{4D}{l}$ where $v_0$ is the critical velocity at which the atmospheres

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L 14318-65
ACCESSION NR: AT4043056

begin to be carried away by the mobile dislocations, D the diffusion coefficient of the admixture, and l the characteristic length. This formula is further developed. The critical deformation rate increases with temperature but does not depend on the hydrogen content of the alloy, while the temperature $T_0$ at which plasticity is restored and the related $T'_0$ depend on the mean hydrogen concentration. The temperature interval within which hydrogen brittleness can develop is bounded above by the dissociation temperature of the Kottrell atmospheres ($T_0$) and below by $T_H$, below which the dislocations leave the Kottrell atmospheres. The point of intersection of the curves characterizing these temperatures determines the maximal admissible hydrogen concentration for which no hydrogen brittleness will appear at a given deformation rate. This theory affords explanation of the regularities observed for the above alloys: their tendency towards hydrogen brittleness with increased hydrogen content, decreased temperature and decreased deformation rate; the intercrystalline character of the break; higher temperatures for transit from viscous to brittle break with increased hydrogen content. The regularities to be expected from the dislocation theory agree satisfactorily with experimental data for the alloy Ti140A (0.0375% by weight $H_2$). Orig. art. has: 5 figures and 4 formulas.

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L 14318-65
ACCESSION NR: AT4048056

SUBMITTED: 15Jul64 ENCL: 00 SUB CODE: MM

NO REF SOV: 003 OTHER: 002

Card 3/3

BR

ACCESSION NR: AT4037646 S/2981/64/000/003/0046/0050

AUTHOR: Livanov, V. A.; Yelagin, V. I.; Shteyninger, V. R.

TITLE: Effect of beryllium admixtures on the properties of malleable magnalium with 9% Mg

SOURCE: Alyuminiyevy*ye splavy*, no. 3, 1964, Deformiruyemy*ye splavy* (Malleable alloys), 46-50

TOPIC TAGS: magnalium, malleable magnalium, magnalium mechanical property, magnalium oxidizability, beryllium admixture, aluminum, aluminum alloy, aluminum magnesium alloy

ABSTRACT: The effects of 0.001 - 1.0% Be on the oxidizability and mechanical properties of magnalium at room and high temperatures were studied on four alloys, each containing 9% Mg and varying amounts of Mn (0.4 - 0.6%), Ti (0.0 - 0.2%) and Cr (00 - 0.2%). Samples were obtained from continuously cast (280 mm/min, 690-700C) and homogenized (36 hrs, 480C) ingots, hot rolled crosswise to strips 6 mm thick, then lengthwise to sheets 1.8 mm thick. The sheets were annealed at 350C. Results indicate that Be in these concentrations does not affect tensile strength, relative elongation or yield point. The latter

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Card 2/2

L 26109-65 EWT(1)/EWT(m)/EWP(w)/EWA(d)/EPR/T/EWP(t)/EWP(b) Ps-4 IJP(c)
ACCESSION NR: AP4047492 MJW/JD S/0149/64/000/004/0124/0129

40
39
B

AUTHOR: Livanov, V.A.; Bukhanova, A. A.; Kolachev, B. A.; Neverova-Skobeleva, N. P.; Slavina, L. I.; Sheynin, B. Ye.; Shcherbina, L. V.

TITLE: Effect of hydrogen on the mechanical properties of titanium and OT4-1 alloy

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 4, 1964, 124-129

TOPIC TAGS: titanium, titanium alloy, titanium mechanical property, titanium alloy strength, hydrogen content, brittle failure, alloy OT4-1

ABSTRACT: The aim of this work was to study the influence of hydrogen on the mechanical properties of OT4-1 alloy, particularly on the impact strength, and to establish the maximum permissible hydrogen content at which the high resistance of the metal to brittle failure is still retained. For comparison, identical tests were carried out on technical-grade titanium, brand VT1-1. It was found that of all the properties studied, the impact strength of VT1-1 and OT4-1 was the most sensitive to changes in hydrogen content. The lower this content, the lesser the tendency of the titanium alloys toward brittle failure. The authors were unable to establish the maximum permissible hydrogen

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ACCESSION NR: AP4047492

content and indicate the need for further investigations in this direction. Heating of OT-4 to 900C followed by cooling in air or in water reduces the adverse effect of hydrogen on the impact strength (at the hydrogen contents studied, i.e., up to 0.01%). However, additional experiments are needed for a better understanding of the stability of the properties obtained during the heat treatment and in the course of natural and artificial aging. Orig. art. has: 5 figures and 5 tables.

ASSOCIATION: Kafedra metallovedeniya i tekhnologii termicheskoy obrabotki, Moskovskiy aviatsionnyy tekhnologicheskiy institut (Metal science and heat treatment department, Moscow aviation technology institute)

SUBMITTED: 30Aug63 ENCL: 00 SUB CODE: MM

NO REF SOV: 002 OTHER: 001

Card 2/2

L 22343-66 EWT(m)/EWP(w)/EWA(d)/T/EWP(t) IJP(c) MJW/JD/GS

ACC NR: AT6012399 SOURCE CODE: UR/0000/65/000/000/0251/0257

AUTHOR: Livanov, V. A.; Nartova, T. T.; Faynbron, S. M.; Ryabova, R. M.

ORG: none

TITLE: Dependence of the tensile properties and heat-resistance of ST1 titanium alloy on heat treatment

SOURCE: Soveshchaniye po metallokhimii, metallovedeniyu i primeneniyu titani i yego splavov, 6th. Novyye issledovaniya titanovykh splavov (New research on titanium alloys); trudy soveshchaniya. Moscow, Izd-vo Nauka, 1965, 251-257

TOPIC TAGS: titanium alloy, aluminum containing alloy, tin containing alloy, alloy heat treatment, alloy property /ST1 alloy

ABSTRACT: Two heats of ST1 titanium alloy (Ti-Al-Sn system) with contents of alloying elements at the upper (ST1V) and lower (ST1N) limits were tested to determine the effect of heat-treatment conditions on tensile and heat-resistance characteristics. Specimens cut from forged alloy bars were annealed at 650—1200C and air cooled or water quenched. The critical temperature of $\alpha \rightleftarrows \alpha + \beta$ transformation was found to be 1000—1030C; the structure of specimens annealed at 700—950C consisted only of α-phase. Both types of alloy have a two-phase $\alpha + \beta$ structure after annealing at 1000—1050C. The best combination of properties in ST1N alloy was achieved by annealing at 800C followed by air cooling and in ST1V alloy, by annealing at 1000C followed

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L 22343-66

ACC NR: AT6012399

2

by water quenching. Tested at 700C after treatment under these conditions, the alloys' tensile strength was 43—50 kg/mm$^2$ for STlN alloy and 53—70 kg/mm$^2$ for STlV alloy. The respective 100-hr rupture strength of STlN and STlV alloys at 600C was 25.5 and 28.0 kg/mm$^2$ and at 700C, 6.0 and 8 kg/mm$^2$. STlV alloy, water quenched from 1050C and tested at 800C under a stress of 20 kg/mm$^2$, had a rupture life of 6—7 hr. The lowest creep rate at 750C in STlN alloy was achieved by annealing at 1050—1150C followed by air or water cooling. Orig. art. has: 5 figures and 2 tables. [AZ]

SUB CODE: 11, 13/ SUBM DATE: 02Dec65/ ORIG REF: 003/ ATD PRESS: 4241

Card 2/2 dda

L 61833-65 EWT(m)/EWP(w)/EPF(c)/EWA(d)/T/EWP(t)/EWP(k)/EWP(z)/EWP(b)/EWA(c)
Pf-4/Pr-4 IJP(c) KW/JD/JH/EM

ACCESSION NR: AP5016350 UR/0149/65/000/002/0131/0135
669.295

AUTHOR: Kolachev, B. A.; Livanov, V. A.; Bukhanova, A. A.; Gusel'nikov, N. Ya.

TITLE: Effect of cooling rate on the tendency of α titanium alloys toward hydrogen brittleness

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 2, 1965, 131-135, and insert facing p. 134

TOPIC TAGS: titanium alloy, hydrogen brittleness, tensile stress, metal deformation

ABSTRACT: In order to study the hydrogen brittleness of α alloys, the effect of hydrogen on the structure and properties of VT5 and VT5-1 alloys (after furnace cooling in air and quenching in water) was investigated. Contrary to the prevailing view, it was shown that these alloys, like (α + β)-alloys, tend to display hydrogen brittleness under certain conditions, when the cross-bars of the tensile impact testing machine move at slow rates. This brittleness develops to the greatest extent in quenched α titanium alloys. The approach used in determining the hydrogen brittleness in these alloys is therefore the same as that used for (α + β)-alloys.

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L 61833-65

ACCESSION NR: AP5016350

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In the case of annealed α alloys, the mechanical properties should be determined by tests involving high deformation rates, in particular, impact tests; in the case of quenched α alloys, the cross-bars of the machine should be displaced at slow rates. The hydrogen brittleness of quenched α titanium alloys which develops at slow deformation rates is due to the decomposition of supersaturated solutions of hydrogen in the α phase under the influence of the applied stresses. The hydrides separating from the supersaturated solutions under the influence of these stresses are preferentially arranged perpendicular to the direction of the tensile stresses, causing brittle failure. Orig. art. has: 4 figures.

ASSOCIATION: Kafedra metallovedeniya i termicheskoy obrabotki, Moskovskiy aviatsionnyy tekhnologicheskiy institut (Department of Physical Metallurgy and Heat Treatment, Moscow Aviation Technological Institute)

SUBMITTED: 03Jan64 ENCL: 00 SUB CODE: MM, TD

NO REF SOV: 003 OTHER: 000

Card 2/2

L 58361-65 EWT(m)/EWA(d)/I/EWP(t)/EWP(z)/EWP(b)/EWA(c) IJP(c) MJW/JD
ACCESSION NR: AP5013151 UR/0129/65/000/005/0009/0015

AUTHOR: Kolachev, B. A.; Livanov, V. A.; Bukhanova, A. A.; Gusel'nikov, N. Ya. 37 B

TITLE: The effect of hydrogen on the mechanical properties of quenched Ti alloys

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 5, 1965, 9-15

TOPIC TAGS: titanium alloy, metal mechanical property

ABSTRACT: The structure and properties of VT3-1, VT8, and VT6 alloys were studied with respect to the effects of hydrogen. After processing, rods of 60-70 mm diameter were heat treated in various ways to retain or to remove hydrogen. The removal was done by heating in a vacuum furnace at 900°C for 6 hrs, and furnace cooling. The properties were then compared to samples annealed by standard procedures. Vacuum annealed samples had higher ductilities and retained approximately the same strength levels. The effects of hydrogen were related to the mechanical properties of the Ti alloys, both after quenching, and after quenching and room temperature aging. In general, strength increased and ductility diminished with increased hydrogen content (0.001 to 0.04% H). The aging treatment offset the curves of strength and ductility, with ductility gradually diminishing with increased aging

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L 58361-65
ACCESSION NR: AP5013151

times. Tests were run on VT6 alloy at high and low speeds of deformation. The mechanical properties did not change significantly, even at high contents of hydrogen. Microstructural analysis of all the alloys in the quenched condition shows the effect of increasing hydrogen contents. In general, increasing the H level resulted in an increased amount of martensitic phase in the α-matrix. No changes were noticed in the structures after prolonged room temperature aging.
Orig. art. has: 2 figures, 4 tables.

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: MM

NO REF SOV: 000 OTHER: 000

Card 2/2

L 5031-66 EWT(l)/EWT(m)/EWA(d)/EWP(t)/EWP(z)/EWP(b) IJP(c) MJW/JD

ACC NR: AP5022342 SOURCE CODE: UR/0149/65/000/003/0131/0135

AUTHOR: Kolachev, B. A.; Livanov, V. A.; Bukhanova, A. A.; Gusel'nikov, N. Ya.

ORG: Moscow Aviation Technological Institute (Moskovskiy aviatsionnyy tekhnologicheskiy Institut)

TITLE: Effect of hydrogen on the structure and properties of VT15 alloy

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 3, 1965, 131-135

TOPIC TAGS: alloy, titanium alloy, aluminum containing alloy, molybdenum containing alloy, chromium containing alloy, hydrogen containing alloy, alloy structure, alloy property/VT15 alloy

ABSTRACT: The effect of hydrogen on the structure and properties of VT15 β-aluminum alloy (3.7% Al, 7.35% Mo, 10.6% Cr, 0.11% Fe, 0.04% Si, 0.03%C, and 0.12% $O_2$) has been investigated. Forged bars 14 x 14 x 70 mm of twice vacuum-arc melted alloy were vacuum annealed at 900C for 6 hr, impregnated with hydrogen, annealed at 780C for 1 hr, and water quenched. Some bars after quenching were aged at 480C for up to 24 hr. It was found that the tensile and yield strengths of as-quenched alloy increased somewhat as the hydrogen content increased from 0.1 to 0.2%; the elongation and reduction of area dropped, however, the latter from 65.8% at 0.002% hydrogen to 53.4% at 0.2% hydrogen. At a

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ACC NR: AP5022342

deformation rate of 4 mm/min, the tensile and yield strengths were higher than those obtained at a deformation rate of 0.4 mm/min at all hydrogen contents. The tensile strength of aged alloy is not affected by hydrogen at contents up to 0.05%, but drops with a further increase in hydrogen: at hydrogen contents of 0.002, 0.05, and 0.1% the tensile strength was 168, 169, and 152 kg/mm$^2$. Elongation and reduction of area increase from 3 and 10% at 0.002% hydrogen to 7 and 13% at 0.1% hydrogen. The structure of as-quenched alloy consisted of only the β-phase at all hydrogen contents. In aged alloy, the amount of precipitated α-phase decreases with increasing hydrogen content. Thus, hydrogen at contents up to 0.2% does not cause an embrittlement of heat-treated VT15 alloy at room temperature. It increases the stability of β-phase and reduces the rate of β-phase decomposition and the rate of α-phase formation. Orig. art. has: 4 figures. [AZ]

SUB CODE: MM/ SUBM DATE: 03Jan64/ ORIG REF: 004/ OTH REF: 001/

ATD PRESS: 4132

BC

Card 2/2

L 37166-66 EWT(m)/T/EWP(t)/ETI/EWP(k) LJP(c) JD/HW/GD/JH

ACC NR: AT6016422 (A) SOURCE CODE: UR/0000/65/000/000/0151/0157

AUTHORS: Livanov, V. A.; Golokhmatova, T. N.; Berezko, R. M.; Vasil'yeva, Ye. N. 46

ORG: none

TITLE: Structural inhomogeneity of the cladding layer in sheets of alloy D16

SOURCE: AN SSSR. Institut metallurgii. Metallovedeniye legkikh splavov (Metallography of light alloys). Moscow, Izd-vo Nauka, 1965, 151-157

TOPIC TAGS: titanium containing alloy, manganese containing alloy, aluminum alloy / D16 aluminum alloy

ABSTRACT: The effect of hot and cold rolling of alloy D16 sheets on the homogeneity and structure of the aluminum surface layer of the sheets was investigated. The investigation was initiated to determine the mechanism for the formation of large crystal grains in the surface layer of D16AT and D16ATV hot rolled sheets. The effect of adding titanium, manganese, zirconium, and boron on the crystal grain size in the surface layer of the hot rolled sheets was also studied. The experimental results are presented graphically (see Fig. 1). Whereas additions of Zn and B had no effect on the crystal grain size, additions of Ti considerably lowered the crystal grain size, and additions of Mn completely removed any inhomogeneity in the aluminum surface layer of the alloy.

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L 37166-66

ACC NR: AT6016422

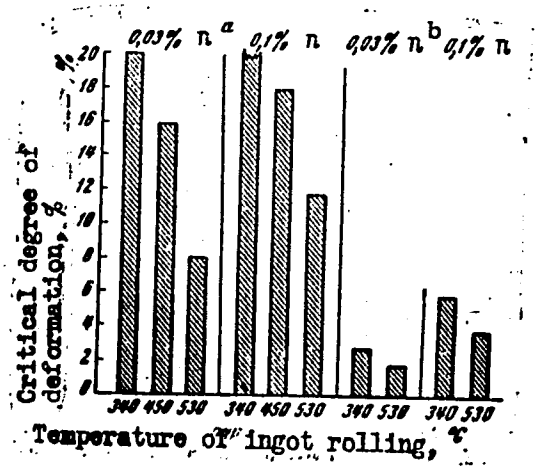


Fig. 1. Critical degree of deformation of aluminum for deformation at room temperature as a function of the titanium content and temperature of hot rolling of aluminum cladding ingots. a - cold rolled aluminum (thickness 2.0 mm); b - surface layer of hot rolled alloy D16.

Orig. art. has: 4 figures.

SUB CODE: 11/ SUBM DATE: 16Sep65/ ORIG REF: 001

Card 2/2 af

L 40092-66 EWT(m)/T/EWP(t)/ETI/EWP(k) IJP(c) JD/HW/DJ/GD/JH

ACC NR: AT6016429 (A) SOURCE CODE: UR/0000/65/000/000/0204/0209

AUTHORS: Livanov, V. A.; Shteyninger, V. R.; Molodchinina, S. P.; Molodchinin, Ye. V.; Senishenkov, A. V.

52
51
B11

ORG: none

TITLE: The rolling of thin-walled tubes from slightly deformable aluminum alloys

SOURCE: AN SSSR. Institut metallurgii. Metallovedeniye legkikh splavov (Metallography of light alloys). Moscow, Izd-vo Nauka, 1965, 204-209

TOPIC TAGS: aluminum alloy, metal ~~working~~ deformation, roll forging, ~~forging machinery~~ hot rolling, metal tube / D1 aluminum alloy, D16 aluminum alloy, AMg6 aluminum alloy

ABSTRACT: Tests were performed to determine the feasibility and best means of producing thin-walled tubes of alloys D1, D16 and AMg6 by the method of heat rolling. Test data recordings show the mechanical properties of alloy specimens as a function of temperature and as a function of the process by which the alloy is milled. Improved technological properties of the tube specimens are afforded by the hot-rolling process. It was found that alloys D1 and D16 are easily rolled in the temperature interval 120--220C without intermediate tempering. Alloy AMg6 (with no restriction on chemical content) can, in the annealed state, be rolled in the same temperature interval. The maximum rolling temperature for AMg6 in the nonannealed condition is about 150C. The hot-rolling technique is more productive than the cold

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L 40092-66

ACC NR: AT6016429

technique when the production is carried out on the KhPT system. For alloys which are only slightly deformable, the use of the hot-rolling technique results in profitable production as opposed to the unprofitable record of previous production; also the product line is wider with the hot-rolling technique. Additional benefits discussed are the low capital outlay required for implementing this technique, the ease of conversion to the technique, and the reduction in wear on production equipment. Orig. art. has: 3 tables.

SUB CODE: 13, 11/ SUBM DATE: 16Sep65

Card 2/2

L 38552-66 EWT(m)/EWP(k)/T/EWP(w)/EWP(t)/ETI IJP(c) GD/JD/HW
ACC NR: AT6012393 SOURCE CODE: UR/0000/65/000/000/0212/0220

AUTHORS: Kolachev, B. A.; Livanov, V. A.; Gusel'nikov, N. Ya.; Bukhanova, A. A.

ORG: none

TITLE: On certain general principles of the occurrence of hydrogen brittleness in alloys VT3-1 and VT15

SOURCE: Soveshchaniye po metallokhimii, metallovedeniyu i primeneniyu titana i yego splavov, 6th. Novyye issledovaniya titanovykh splavov (New research on titanium alloys); trudy soveshchaniya. Moscow, Izd-vo Nauka, 1965, 212-220

TOPIC TAGS: crack propagation, titanium containing alloy, alloy, martensite alloy, material deformation, hydrogen embrittlement / VT3-1 martensite alloy, VT15 alloy

ABSTRACT: A review is made of certain principles of hydrogen brittleness in alloys VT3-1 and VT15. The brittleness of ($\alpha$ + $\beta$)-titanium alloy VT3-1 is more intense at temperatures below room temperature and at low rates of deformation. $\beta$-titanium alloys at lower-than-room temperatures also tend toward hydrogen brittleness. The temperature of the occurrence of hydrogen brittleness decreases with increasing hydrogen content. Hydrogen brittleness of alloy VT15 occurs only at low rates of deformation in a narrow temperature interval from -30 to 10C. The brittleness of ($\alpha$ + $\beta$)-titanium alloys depends upon processes occurring in the $\beta$-phase during

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L 38552-66

ACC NR: AT6012393

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plastic deformation. Since the β-phase content in alloy VT3-1 is, after isothermal annealing, similar to that in alloy VT15, the hydrogen brittleness in each develops in the same pattern under identical conditions of mechanical testing. The dislocation theory satisfactorily describes the brittleness phenomenon. The dislocations transport hydrogen to the edges of the grain, thus causing segregations of hydrogen leading to formation and propagation of cracks. The microscopic nature of crack formation and how hydrogen segregation serves to prevent plastic deformation at the tip of cracks are discussed. Orig. art. has: 8 figures.

SUB CODE: 11/ SUBM DATE: 02Dec65/ ORIG REF: 008/ OTH REF: 010

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L 36529-66 EWT(m)/EWP(w)/T/EWP(t)/ETI IJP(c) JD/GD

ACC NR: AT6012396 SOURCE CODE: UR/0000/65/000/000/0238/0242

AUTHORS: Kornilov, I. I. (Doctor of chemical sciences, Professor); Livanov, V. A.; Belousov, O. K.; Faynbron, S. M.; Mikheyev, V. S.; Ivanova, S. Ye.; Ryabova, R. M.

ORG: none

TITLE: The effect of thermal processing on the mechanical properties of type AT2 alloys

SOURCE: Soveshchaniye po metallokhimii, metallovedeniyu i primeneniyu titana i yego splavov, 6th. Novyye issledovaniya titanovykh splavov (New research on titanium alloys); trudy soveshchaniya. Moscow, Izd-vo Nauka, 1965, 238-242

TOPIC TAGS: titanium, titanium alloy, tempering, thermal treatment / AT2 titanium alloy

ABSTRACT: The results are given for studies of the effect of thermal processing on the mechanical properties of type AT2 alloys. Several compositions were investigated, which displayed high plastic and shock-resistance properties at room and at low (-196 and -253C) temperatures. These alloys were given the designations AT2-1, AT2-2, and AT2-3, and were produced in sheets in industrial conditions. Measurements were made of the dependence of the resistivity of these compositions on the testing temperature (see Fig. 1). Thermal processing was bounded in the temperature range 500--1000C. The thermal process included: 1) heating at the prescribed temperature for 30 minutes; 2) 60-minute air-cooling, and 3) 60-minute oven cooling. The mechanical properties of the

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L 36529-66

ACC NR: AT6012396

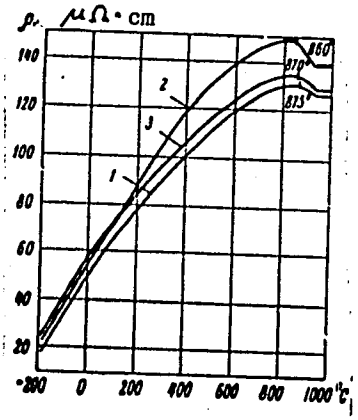


Fig. 1. The dependence of the resistivity on the testing temperature of alloys AT2. 1 - AT2-1; 2 - AT2-2; 3 - AT2-3.

alloys are related to the observed changes in the alloy microstructure occurring with varied thermal processing. Recommendations are: 30- to 60-minute thermal treatment at 500 to 600C with subsequent air cooling for alloy AT2-1; 600C processing for alloy AT2-2; and 500--600C processing for AT2-3. The optimal mechanical properties obtained with the recommended processing are summarized. Orig. art. has: 5 figures.

SUB CODE: 11/ SUBM DATE: 02Dec65/ ORIG REF: 008

Card 2/2 mlp

L 40237-66 EWT(l)/EWT(m)/EWP(t)/ETI IJP(c) JD
ACC NR: AP6019642 SOURCE CODE: UR/0149/66/000/003/0094/0102

AUTHOR: Kolachev, B. A.; Livanov, V. A.; Bukhanova, A. A. 27 B

ORG: Department of Metallography and Thermal Processing, Moscow Aviation Technological Institute (Moskovskiy aviatsionnyy tekhnologicheskiy institut. Kafedra metallovedeniya i termoobrabotki)

TITLE: Phase diagram of the system titanium-oxygen-hydrogen

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 3, 1966, 94-102

TOPIC TAGS: titanium compound, oxygen compound, hydrogen compound, phase diagram

ABSTRACT: The isotherms of the equilibrium pressure of hydrogen in the system Ti-O-H were plotted at temperatures of 700 and 800C. Oxygen was found to increase the equilibrium pressure of hydrogen in the system, especially at a content of more than 5 wt. %. The isotherms have sharp bends corresponding to the transition from one phase region to another which permits finding the boundaries of all phase regions of the system in the investigated concentration range of oxygen and hydrogen except the interface between the $\alpha + \beta$ - and $\beta$ - regions. Isobars of the equilibrium pressure of hydrogen in the system were plotted at 700 and 800C, from which the position of the conodes in the two-phase region and the boundary between the $\alpha + \beta$ - and $\beta$ -regions were established. The isothermal cross sections of the

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ACC NR: AP6019642

phase diagram of the system were plotted at 700 and 800C from the isotherms and isobars of the hydrogen equilibrium pressure. It is shown that the heat of solution of hydrogen in the α-phase is virtually independent of the oxygen content up to 3 wt. % and amounts to about 22,400 cal/mole. At higher oxygen contents the heat of solution of hydrogen in the α-phase increases (with consideration of the sign) and amounts to 17,200 cal/mole at 10.10 wt. % $O_2$. Orig. art. has: 1 table and 7 figures.

SUB CODE: 07,11/ SUBM DATE: 03Mar65/ ORIG REF: 004/ OTH REF: 011

Card 2/2

L 10083-67 EWT(m)/EWP(w)/EWP(t)/ETI IJP(c) JD/JH

ACC NR: AP6029676 (A) SOURCE CODE: UR/0136/66/000/008/0088/0090

AUTHORS: Kolachev, B. A.; Livanov, V. A.; Drozdov, P. D.; Bukhanova, A. A.

ORG: none

TITLE: Mechanical properties of alloy MA2-1 containing different concentrations of hydrogen

SOURCE: Tsvetnyye metally, no. 8, 1966, 88-90

TOPIC TAGS: magnesium alloy, hydrogen, hydrogen embrittlement / MA2-1 magnesium alloy

ABSTRACT: The mechanical properties of the alloy MA2-1 were determined as a function of its hydrogen content. The investigation was initiated to corroborate a mechanism for hydrogen embrittlement in metals, as proposed by B. A. Kolachev, V. A. Livanov, A. A. Bukhanova, and N. Ya. Gusel'nikov (Novyye issledovaniya titanovykh splavov. Izd. Nauka, 1965 s. 212). The mechanical properties of the specimens were ascertained after annealing in air and in vacuum at 300C for 10 hours. The hydrogen content of the specimens, determined after A. P. Gudchenko and A. K. Leont'yev (Sb. Trudy MATI, 1961, vyp. 49, s. 137), was 18 $cm^3$ and 9 $cm^3$ per 100 g respectively. The experimental results are presented graphically (see Fig. 1). It was found that these results agree with the proposed dislocation hypothesis of hydrogen embrittlement.

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L 10683-67

ACC NR: AP6029676

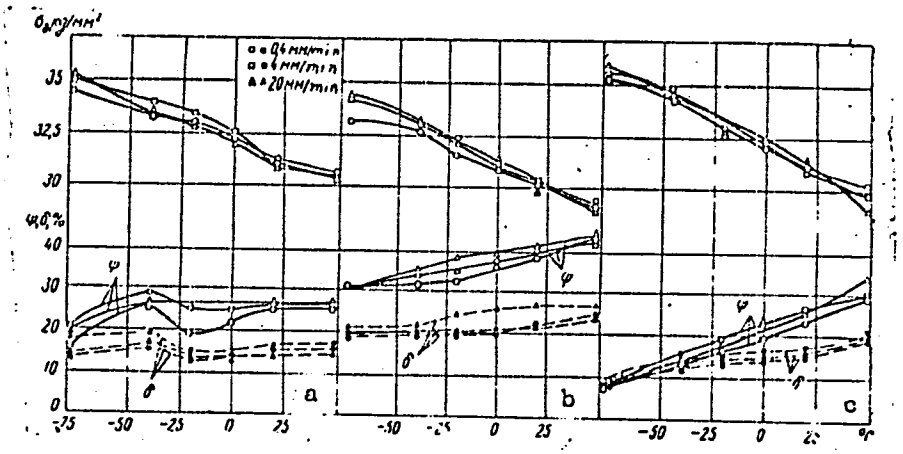


Fig. 1. Influence of the experimental temperature on the mechanical properties of alloy MA2-1: a - hot-pressed state; b - after vacuum annealing at 300C for 10 hours; c - after air annealing at 300C for 10 hours

Orig. art. has: 3 graphs.

SUB CODE: 11/ SUBM DATE: none/ ORIG REF: 003/ OTH REF: 001

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